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Bruhat Bengaluru Mahanagara Palike

DETAILED PROJECT REPORT

CONSULTING SERVICES FOR PREPARATION OF DETAILED PROJECT REPORT FOR

Name of Work: Improvements to Roads and drains of Sahakaranagar Main Road and surrounding areas in ward no. 08 Kodigehalli

COST OF THE PROJECT: 100.00 LAKHS

Submitted To:

The EXECUTIVE ENGINEER,
Road Infrastructure,
Yelahanka,
BBMP, Bangalore.

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CONTENTS

Chapter – 1 Introduction

Chapter – 2 Investigation & Surveys

Chapter – 3 Design Standard & Specification

Chapter – 4 Design & Proposals

Chapter – 5 Project Cost Estimates

Chapter – 6 Executive Summary

Annexure

Annexure A. 1.1 Key Map

Annexure A.4.1 Flexible Pavement Overlay Design

Annexure A.5.1 Detailed Cost Estimate, Rate Analysis, Draft Tender Schedule

Photos

Typical Cross Sections

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Chapter -1

INTRODUCTION

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Chapter -1
INTRODUCTION

1.1.1 Bengaluru is the capital of India's southern Karnataka state. The center of India's high-tech industry, the city is also known for its parks. It is also known as the Garden City because of its many beautiful gardens and parks. By Cubbon Park, Vidhana Soudha is a Neo-Dravidian legislative building. Former royal residences include 19th-century Bangalore Palace, modeled after England's Windsor Castle, and Tipu Sultan's Summer Palace, an 18th-century teak structure During the last couple of decades, city has witnessed drastic increase in population, change in land use pattern of the city, life style of the people and their commuting habits and the revolutionary changes that has taken place in the automobile industry. This has contributed to the growth of vehicular traffic in an enormous way.

1.1.2 It also called the Silicon Valley of India , because of the high concentration of IT industry. Bangalore is rated to one of the fastest growing cities in Asia with a current population of more than 10 million. During the last couple of decades, city has witnessed drastic increase in population, change in land use pattern of the city, life style of the people and their commuting habits and the revolutionary changes that has taken place in the automobile industry.

.1.3 The Bangalore city population is currently more than 11 million and increasing in a forward march. The lifestyle of the citizens is changing day to day due to globalization and introducing of new brands in all sector. Bangalore, the fastest growing city of India, comprises of a dynamic blend of people, belonging to various religions, castes and communities. With the introduction of information technology in the city, it has assumed an international character. IT professionals not only from the various parts of India, but also that of the world, are migrating to the city. This has led to Bangalore becoming more like the melting pot of various cultures. Read on to know more about the people and lifestyle of Bengalooru, India. What adds to the traffic pressure in Bengaluru in particular is that there is very little scope for expansion of roads and the need to use existing roads for smooth movement of vehicles is even more pronounced. It thus becomes mandatory for the administration to ensure better parking facilities. So far, the government and the BBMP have not taken this issue seriously and now the situation is such that it needs to be addressed seriously and effectively. Rapid population growth because of IT and other associated industries in Bengaluru led to an increase in the vehicular population to about 1.5 million, with an annual growth rate of 7-10%. With the increase in population and the expansion of the city, the problem of connectivity of the populace has arisen. Quite obviously personalized modes of transport have grown at a tremendous rate and two wheelers along with the cars

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roads and drains of Sahakaranagar Main Road and surrounding areas in ward no. 08 Kodigehalli

almost comprise 90% of the total registered vehicular population in the city. Two wheelers constitute more than 70% of the total volume while cars comprise 15%, autos 4% and the remaining 8% includes other vehicles such as buses, vans and tempos.

1.4 The combined effect of all these on the road network of Bangalore is delay and congestion beyond tolerable limits. Vehicular conflicts at the intersections are being eliminated by traffic signals but at the expense of delays and long queues. The peak hour has spread over a longer period of time since there are no perceptible capacity augmentation / conflict reduction measures.

1.5 As a comprehensive development programme for improvement of road network, the Bruhath Bangalore Mahanagara Palike (BBMP) has planned Improvements to function, widening / Improvements of roads, strengthening of pavement base and sub - base, improvement to pedestrian facilities, improvements to Drainage Facility, etc. This response is the answer to the severe strain on the urban infrastructure, which is inevitable due to the very rapid rate of growth in traffic. Travel demands of passengers have increased many folds in the last two decades. Unfortunately growth in the infrastructure is not commensurate with the growing demands of traffic. There is an exigent need to effectively manage the traffic and transportation systems to optimize the solutions with short term afid long - term measures.

.2 Project Location

The Project includes Improvements to Roads and drains of Sahakaranagar Main Road and surrounding areas in ward no. 08 Kodigehalli. The Project area is falls under Yelahanka Division, Byatarayanapura Assembly Constituency in Bangalore City. The Project area is located thickly populated Residential cum Commercial area. The Project Stretch includes Arterial roads and Sub-Arterial roads. For the habitation resided in this area it was very difficult to commute on this stretch in the Rainy season due to non proper flow of water on the Roads and lack of proper drainage facility. By considering these reasons the roads are taken up for Development with Asphalting or White topping depending upon the site scenario.

Key Map of the roads proposed is enclosed in **Annexure A.1.1.**

M/s. NEWZEN CONSULTANTS BANGALORE is entrusted by BBMP to carry out the work of Preparation of Detailed Estimate and Report for the above said work.

Accordingly we **M/s. NEWZEN CONSULTANTS BANGALORE** have commenced the consultancy works as per the scope of services described in the RFP document.

1.3 Scope of Work

The Scope of Services of the Consultancy includes the following:

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Inventory and condition surveys for existing road & pavement. cross drainage structures and bridges.

- Engineering surveys and investigations
- Improvement to the existing pavement and drains. such as horizontal and vertical alignment. curve straightening, rising of the road level in low lying areas above the HFLs. concentric widening / eccentric widening etc.
- Design of Pavement.
- Overlay Design.
- Design of lateral side drains and Cross drainage works such as culverts etc
- Rate analysis of scheduled items, BOQ and Cost estimates.
- Final Detailed Project Report and final drawings
- Photos of the project roads or site

1.4 Contents of the Report

The Methodology, as detailed in the Project proposal, it has been followed for carrying out the necessary Investigations and for the Preparation of Detailed Estimate and Report.

This Report includes the following.

- Chapter 2: Investigation & Surveys
- Chapter 3: Design Standard & Specification
- Chapter 4: Design & Proposals
- Chapter 5: Project Cost Estimates
- Chapter 6: Executive Summary

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Annexure A. 1.1

KEY MAP

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Chapter -2

INVESTIGATION & SURVEYS

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Chapter -2
ENGINEERING SURVEYS AND INVESTIGATIONS

2.1 General

Various surveys and investigations that are the essential inputs for detailed engineering design are detailed in this chapter. All the relevant maps, data, details available with the concerned departments have been collected, compiled and reviewed. Particular attention has been given to past historical data, reports. A review of the past data available in the various studies has been listed out and such available data has been made use of, after updating / augmenting the data wherever necessary. The data as collected has been made use of in analysis, design, formulation of improvement proposals and costing. The activities have been performed on several fronts fully complying with the requirements. The activities that are carried out are brought out hereunder.

The various engineering surveys / investigations of the road sections include:

- Reconnaissance Survey
- Visual Topographical Survey
- Road Inventory Survey
- Pavement Condition Survey.
- Visual Condition Survey.
- Structure Condition Survey
- Soil, geo-technical, material, hydrology and drainage surveys

2.2 Reconnaissance Survey

Reconnaissance Survey of the road, considered for improvements, has been carried out to identify the general condition of roads, drains, culverts and bridges for further surveys / investigations, to understand kind of establishments along the stretches of roads and to work out land acquisition scheme. Making use of the observations / data collected during reconnaissance survey, detailed schedule for surveys / investigations required for the project has been finalized.

2.3 Visual Topographical Survey

Topographic Survey has been conducted all along the corridor by physically measuring the Road Width, Footpath Width, Drain Width, Alignment of Road and with the aid of Google Maps.

2.4 Road Inventory Survey

A detailed inventory and condition survey of road sections has been carried out by making use of well structured inventory data format. It was compiled in tabular form, developed using Excel computer software. Various data collected during the road inventory broadly include.

- Type of terrain.
- Land use.
- Carriageway width.

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- Type of surfacing
- Shoulder, Median, Drain (tertiary / shoulder), Footpath - type and width.
- Road Geometry
- Road Furniture
- Salient Buildings & Structures
- Road Intersection(s) and their details.
- Land width (RoW)
- Culverts, bridges and other structures (type, size, span arrangement and location).
- General drainage conditions

2.5 Pavement Condition Survey

The Pavement Condition Survey has been carried out in accordance with IRC Guidelines. All surveys and investigations have been carried out with the following objectives:

- To have an up to date record of road assets.
- To have a clear understanding of road side features including land use, drainage characteristics, etc. and
- To assess the condition and strength data for developing improvement proposals and related designs.

2.5.1 Visual Condition Survey

Visual Condition Survey of the road sections has been carried out by travelling along the patching, rutting, pot holes, edge breaking, etc. by visual observations in a well structured data format. The data so collected has been compiled and presented (kilometer wise) in the form of tables for easy understanding. This data has been used to assess the pavement condition.

2.5.2 Soil, geotechnical, material, hydrology and drainage surveys

i) The activities and Deliverables forming part of the soil, geotechnical, material, hydrology and drainage surveys are described below:

(a) The characteristics of the existing soil of the Project road.

(b) The determination of sub grade CBR (soaked) Project road.

(c) Benkelman Beam Deflection measurements on the Project road for overlay stretches.

(d) Preliminary hydraulic data for bridges, design discharge, HFL, LWL, etc. with a view to checking adequacy of existing waterway.

(e) A broad assessment of the drainage condition and requirement of the Project Highway.

ii) Road signs, safety devices

(a) The provision of Road Signs, Pavement Markings, Safety Barriers, Railings, Delineators, Chevron Markings, Traffic Attenuators. It shall also include Crash Barriers for existing bridges.

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Chapter -3
DESIGN STANDARD & SPECIFICATION

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Chapter -3
DESIGN STANDARD & SPECIFICATION

3.1 General

Planning and design of roads & CD structures, pedestrian facilities and street furniture are essentially based on the IRC standards and MoRT&H specifications. Whenever, the codes / standards are silent on some of the aspects, the same has been planned / designed based on sound engineering practices. Design standards relevant to the project road along with the broad list of design parameters and the relevant IRC codes / specifications have been detailed in **Table 3.1.**

Table 3.1: Design Standards

SL No.	Design Parameters	Reference Code
1.	Geometric Design Standards • Carriageway width • Shoulder • Footpath • Median • Camber • Super Elevation • Horizontal Alignment • Vertical Alignment	As per IRC: 38 - 1988, IRC: 86 - 1983 & IRC: SP : 23 – 1993
2.	Road Furniture • Road Delineators • Road Markings • Road Signs	As per IRC: 79 – 1981 As per IRC: 35 – 1997 As per IRC: 67 – 2001
3.	Road Capacity	As per IRC: 106 – 1990
4.	Pavement Design	As per IRC: 37 – 2012 & IRC: 58 – 2011
5.	Overlay Design	As per IRC: 81 – 1997
6.	Road Drainage	As per IRC: SP: 42 - 1994 & IRC: SP: 50 - 1999
7.	Culverts	As per relevant IRC codes and MoRT&H

The project road section passes through plain terrain. Design standards (as appropriate) have been further elaborated under the following heads:

- ❖ Geometric Design
- ❖ Pavement Design
- ❖ Overlay Design
- ❖ Drainage
- ❖ Road Furniture and Appurtenances
- ❖ Bridges and CD Structures

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3.2 Design Standards Related to Geometric Design

Design standards related to road geometric along with the suggested design values standards and recommended values based on site conditions and data analysis are detailed in Table 3.2

Table 3.2: Geometric Design Standards

SL No.	Design Parameters	Design Values
1	Design Speed	Design speed Considered is 40 kmph
2	Geometric Design Standards	
	• Carriageway Width	Two lane/ Four lane carriageway
	• Camber (Bi-directional)	2.5% for paved carriageway
	• Super Elevation	Limited to 4%.
	• Footpath	Minimum width - 1.5m
	• Kerb	Barrier / Semi — barrier / Mountable (Barrier type recommended)
	• Extra Widening at Curves	Nil for Radius above 300 m
	• Gradient	Maximum Gradient - 4.0 % (1 in 25) Minimum Gradient for Drainage - 0.5 % (desirable minimum) & 0.3 % (absolute minimum).

3.3 Design Standards Related to Pavement Design

Design standards related to Pavement design are essentially based on the guidelines given in IRC: 37 - 2012 "Tentative Guidelines for the Design of Flexible Pavements ". The suggested design values / standards and recommended values based on site conditions and data analysis are detailed in Table 3.3 and are adapted in the design.

Table 3.3: Overlay Design Standards

SL No.	Design Parameters	Reference Code / Design Values
1.	Pavement design	IRC: 37 - 2012 " Tentative Guidelines for the Design of Flexible Pavements "
	Initial Traffic	In terms of CVPD, vehicles weighing more than 3 ton
	Traffic growth rate	5%
	Design Life	10 to 15 years
	Vehicle damage factor	1.5 to 4.5
2.	Soil Characteristics	CBR Value

3.4 Design Standards Related to Overlay Design

Design standards related to Overlay design are essentially based on the guidelines given in IRC: 81 - 1997 "Guidelines for Strengthening of Flexible Road Pavements Using

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Benkelman Beam Deflection Technique". The suggested design values / standards and recommended values based on site conditions and data analysis are detailed in Table 3.4 and are adopted in the design.

Table 3.4: Overlay Design Standards

Sl. No.	Design Parameters	Reference Code / Design Values
1	Overlay Design	IRC : 81 - 1997 "Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique"
	• Design Life	10 years
	• Correction Factors	Temperature Correction Factor Correction for Seasonal Variation (inclusive of correction for moisture content, soil type and rainfall)
	• Minimum Thickness	From structural considerations recommended minimum bituminous overlay thickness is 40 mm AC (minimum) or 50mm BM (as required) + 40mm BC
2	Wearing Course Material (Options)	Bituminous Concrete with Crumb Rubber Modified Bitumen / Plastic Waste.

3.5 Design Standards Related to Road Drainage

Drainage of water from pavement surface is of paramount importance as far as preserving the road assets created by investing huge funds in addition to maintaining the structural soundness and functional efficiency of the road. Design standards related to road drainage are essentially based on the guidelines given in IRC: SP: 42 — 1994 "Guidelines on Road Drainage" and in IRC: SP: 50 - 1999 "Guidelines on Urban Drainage". The suggested design values / standards are detailed in **Table 3.5.**

Table 3.5: Design Standards Related to RoadDrainage

SI No.	Design Parameters	Design Values
1.	• Camber	1.7 - 2.5 % (bi - directional) for carriageway (camber of 3% is adopted).
	• Longitudinal Gradient	Minimum 0.3 - 0.5% for satisfactory drainage
	• Drain Type	Cast in situ RCC box drain with Precast RCC cover slab. RCC box culverts across cross roads.
	• For Existing Drains	Desilting and Rectification of Damaged Portion

3.6 Design Standards Related to Road Furniture and Appurtenances

Utility and importance of the road are greatly enhanced by installing road furniture and appurtenances at appropriate locations along the project road, which ensures improved road safety. Planning and design of road furniture and appurtenances are as per the guidelines

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stipulated in IRC. Detailing of each of these components has been done so as to integrate the same with the road improvement scheme. The suggested design values / standards are detailed in Table 3.6.

Table 3.6: Design Standards Related to Road Furniture and Appurtenances

Sl. No.	Design Parameters	Reference Code / Design Values
1	Road Markings	IRC : 35 - 1997 "Code of Practice for Road Markings"
2	Road Signs	IRC : 67 - 2001 "Code of Practice for Road Signs"
3	Road Delineators	IRC : 79 - 1981 "Recommended Practice for Road Delineators"
4	Pedestrian Facilities	IRC : 103 - 1988 "Guidelines for Pedestrian Facilities".

In addition to the above measures various other integral road components have been planned so as to achieve the maximum and optimal use of the carriageway with no / least interference to traffic flow at the same time ensuring adequate facilities to other road users especially pedestrians. All the encroachments, if any shall be cleared within the RoW.

3.7 Design Standards Related to Bridges and CD Structures

The design standards and loading considered for culverts and bridges are as stipulated in latest IRC codes / Special publications supplemented by appropriate MOST circulars and/or IS codes. The unsafe and/or deficient bridge and culvert structures (existing) will be rehabilitated or replaced by sound structures.

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Chapter 4

DESIGN & PROPOSALS

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Chapter -4
DESIGN & PROPOSALS

4.1 General

Improvement proposals for an existing road section essentially consist of two components, geometric and structural improvements. Geometric improvement deals with visible dimensions of roadway, probable road widening and is dictated by the traffic and economic considerations. Due to the inherent restrictions like limitation in land acquisition, limited right of way and existing utilities / services, etc. the horizontal and vertical alignments in general follow the existing geometry except in situations where improvements are possible. The geometric improvements mainly involve improvements to cross sectional elements such as carriageway, shoulders, etc. The structural component deals with the pavement and embankment design aspects, i.e., the ability of the roads to adequately carry and support the Vehicle / wheel loads over the design period. Safety, speed, efficiency, economy and comfort in traffic movement to a large extent are governed by adequacy of design standards used for a specific road facility.

The improvement proposals need to consider the method of widening like concentric or eccentric to the existing road which is dictated by site situations like available land for acquisition, curvature, existing utilities, terrain, places of worship, monuments, grave yards, places of importance etc.

This chapter deals with the analysis of data collected during various engineering surveys/investigations and the formulation of improvement proposals including planning and design.

4.2 Road Inventory and Physical Characteristics of Road Section

Investigations / studies have been carried out along the Project Stretch. Physical characteristics of these road and road Junctions are as follows.

The Project includes Improvements and Asphalting to Main and cross roads of 407 SFS Yelahanka New Town. The Project area is falls under Yelahanka Division, Yelahanka Assembly Constituency in Bangalore City. The Project area is located thickly populated Residential cum Commercial area. The Project Stretch includes connecting roads and cross roads. For the habitation resided in this area it was very difficult to commute on this stretch in the Rainy season due to non proper flow of water on the Roads and lack of proper drainage facility. By considering these reasons the roads are taken up for Development with Asphalting or White topping depending upon the site

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given in IRC: 81-1997.

Step 4: Homogeneous sections for pavement design have been established and design traffic Loadings for each of them identified. Design of flexible pavement for new road has been carried out in accordance with guidelines of IRC: 37-2012.

4.5 Flexible Pavement Design

4.5.1 Design CBR

Existing soil sub grade samples were collected through Trial Pit excavations at Road and shoulder interface. The existing soil sub grade were tested as per IS 2720.

The equivalent CBR is obtained as per IRC 37-2012 Chart for 905 dependability is 10%. Hence the flexible pavement design has been carried out using the IRC code (IRC-37-2012). In this code, pavement designs have been extended to cover up to 150msa and design CBR strengths up to 15%. In order to compute the damage ratio, the allowable repetitions are calculated in terms of the fatigue and rutting. The pavement design was done as per IRC-37-2012 and IIT Pave software. It accepts layer thickness, loading and material characteristics as inputs and has provisions for entering various indigenous data such as rutting and fatigue coefficients, wheel spacing, tyre pressure etc. The analysis is based on the linear elastic, multilayer theory and the stresses and strains developed in various layers of the pavement are obtained.

.5.2 Design Life for Base and Sub-base Layers

The stage construction for first five years of pavement life is considered as an option. It would be appropriate to design the bottom non bituminous layers (base and sub-base) for axle loads expected in the 15 year design period the upper bituminous layers for axle loads expected at the end of 10 year design period. A 15-years design life has been considered for Base and Sub-base layers of flexible pavement.

5.3 Traffic Considerations

The base year traffic, traffic growth and the projected traffic for the design period for each category of vehicles have been arrived from the Traffic Studies. The commercial vehicle considered for the design are based on the vehicular projections considering the actual traffic, the traffic likely to be generated by future developments in the vicinity of the project road. Further, based on the traffic studies the number of commercial vehicles has been adopted.

.4 Traffic Loading

In accordance with the requirement of IRC: 37-2012, the traffic loading for the design period and design lane are to be assessed. Vehicles constituting the commercial vehicles are LCV, 2 Axles, 3 Axles and Multi Axles and Multi Axle Semi Articulated vehicles.

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4.5.5 Design Approach and Criteria of Flexible pavement

Pavement distress resulting from repeated application of traffic:

- Horizontal tensile strain at the bottom of the bituminous layer
- Vertical compressive strain at the top of the Sub grade

4.5.6 Design Standards Related to Pavement Design

Design standards related to pavement design are essentially based on the guidelines given in IRC: 37-2012 – "Tentative Guidelines for Design of Flexible Pavements".

Table 4. 1 Pavement Design Standards

	Design Parameters	Reference Code / Design Values
1.	Pavement Design	IRC: 37-2012- "Tentative Guidelines for Design of Flexible Pavements"
	Traffic Growth Rate	Adopted as per IRC: 37-2012
	Design Life	10 to 15 years
	Vehicle Damage Factor	Derived values based on Axle load survey. If these values are less than national average, then national average will be used.
	Lane Distribution Factor	As per IRC:37-2012
2.	Wearing Course Material	Bituminous Concrete

4.5.7 Information required for estimating design traffic

- Initial traffic in terms of number of Commercial Vehicles per day (CVPD).
- Traffic growth rate during the design life in percentage.
- Design life in number of years.
- Spectrum of axle loads.
- Vehicle Damage Factor (VDF).
- Distribution of commercial traffic over the carriageway.

5.8 Computation of Design Traffic

The design traffic in terms of the cumulative number of standard axles to be carried during the design life of the road should be computed using the following equation:

$$N = \frac{365 * \left[(1+r)^n - 1\right]}{r} * A * D * F$$

Where,

N = Cumulative number of repetitions in terms of million standard axles

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A = Initial traffic in the year of completion of construction in terms of the number of Commercial Vehicles per Day (CVPD)

D = Lane distribution factor (as explained in Para 4.5.1 (IRC: 37-2012)

F = Vehicle Damage Factor (VDF)

n = Design life in years

r = Annual growth rate of commercial vehicles in decimal (e.g., for 5 per cent annual growth rate, r = 0.05)

Traffic Growth Rate

The present day traffic has to be projected for the end of design life at growth rates (r') estimated by studying and analyzing the following data:

(i) The past trends of traffic growth; and

(ii) Demand elasticity of traffic with respect to macro-economic parameters (like GDP or SDP) and expected demand due to specific developments and land use changes likely to take place during design life.

If the data for the annual growth rate of commercial vehicles is not available or if it is less than 5 per cent, a growth rate of 5 per cent should be used.

The traffic in the year of completion is estimated using the following formula:

$$A=P(1+r)^n$$

Where,

P = Number of commercial vehicles as per last count.

n = Number of years between the last count and the year of completion of construction

5.9 Selection of Subgrade CBR for Pavement Design

The CBR values of the sub grade soil vary along a proposed alignment even on a homogeneous section. The pavement design is done based on Considering the CBR of Borrow area for Reconstruction and Widening Section and For Existing portion the CBR of Existing Sub grade / Sub base is considered.

.10 Flexible Pavement Design – Re-construction

The CBR values of the subgrade soil vary along a proposed alignment even on a homogeneous section. The pavement design is done based on Considering the CBR of Borrow area for Reconstruction and Widening Section and For Existing portion the CBR of Existing Subgrade/Sub base is taken.

11 Widening Proposals & Typical Cross Sections

a) Widening options for the project road were arrived based on.

- Lane requirements based on traffic capacity analysis.

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- Requirement of service roads along built-up areas
- Presence of religious structures.
- Availability of land

Formulation of carriageway widening schemes involves 1) estimation of extent of widening required in terms of additional lanes and 2) lateral arrangement of these additional lanes to the existing carriageway. Guidelines for the requirement of additional lanes is derived from, Traffic Study – Projected Traffic Volume vis-à-vis Capacity of each lane / road

Based on the TOR requirement of minimum Land Acquisition, i.e., within the existing ROW as far as possible, and retaining the existing pavement, cross drainage structures and bridges as far as possible, without compromising the recommendations of IRC / MORT&H.

Requirement of service roads along built-up areas. Additional lanes shall be added to the existing road either concentrically or eccentrically, depending on

1. The availability of right of way on either side of the existing centre line,
2. Topography and built-up areas
3. Due to specific field constraints (such as any sensitive features like water bodies, important structures etc.), localized shifting has been emerged at many places.

4.6 Proposed Improvements to Road Section

The proposals for the improvement of the geometric elements of the existing project road sections generally include:

a. Geometric Improvements

- Maintaining Uniform Carriageway.
- Improvements to cross sectional elements.

b. Strengthening of Existing Pavement

- Filling of potholes / damaged portion with WMM.
- Overlay for existing carriageway.
- Strengthening of Carriage way.

c. Road Drainage

- Desilting of Existing Side Drains.
- Rectification of damaged drains.
- Flagging Coarse for Existing Drain.
- Replacing damaged / Missing cover slabs.

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Annexure A.4.1

FLEXIBLE PAVEMENT OVERLAY DESIGN

FLEXIBLE OVERLAY DESIGN:

DESIGN TRAFFIC:

The following equation is used to compute the design traffic in terms of the cumulative number of standard axles

$$Ns = \frac{365 \times ((1+r)^n - 1)}{r} \times A \times D \times F$$

Where,

Ns = Cumulative number of standard axles to be catered for in the design, MSA.

A = Initial Traffic, in terms of commercial vehicles per day modified to account for lane distribution

r = Annual growth rate of commercial vehicles

n = Design life in years

F = Vehicle Damage Factor

D = Lane distribution factor

The design traffic computed in terms of cumulative number of standard axles (msa).

Pavement compositions

Recommended for Surface course of 2 MSA		Recommended Base course of 2 MSA	
BC	**DBM**	**WMM**	**GSB**
30	50	Bad Reaches	

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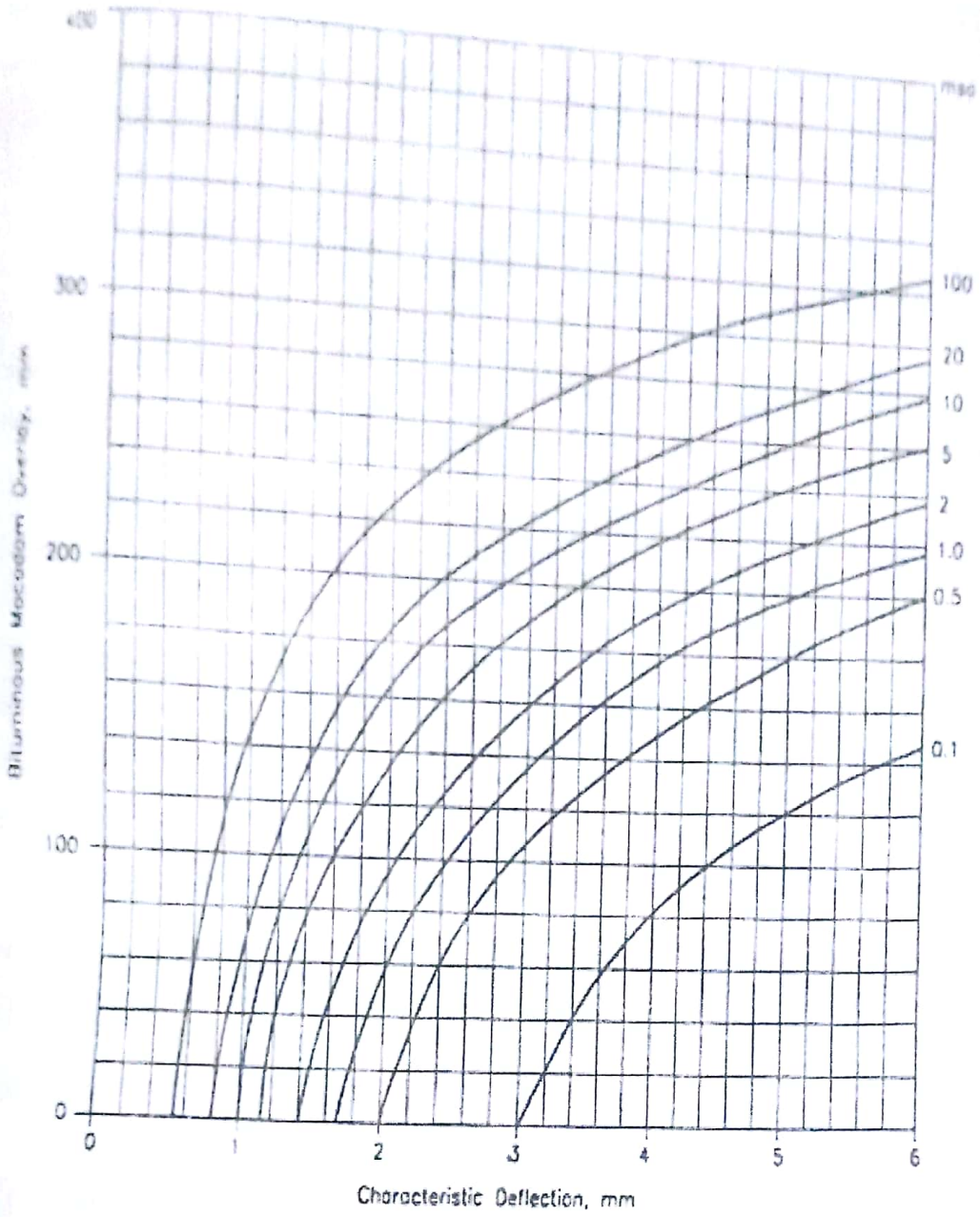

7.4. The thickness deduced from Fig. 9 is the overlay thickness in terms of bituminous macadam construction. In case other compositions are to be laid for strengthening, the equivalent overlay thickness to be provided may be determined using appropriate equivalency factors as suggested below :

1 cm of Bituminous macadam	= 1.5 cm of WBM/Wet Mix Macadam/BUSG
1 cm of Bituminous macadam	= 0.7 cm of DBM/AC/SDC

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Chapter - 5
PROJECT COST ESTIMATES

Detailed Cost Estimate

Detailed cost Estimate has been worked out based on detailed engineering design

General

Cost Estimate is an important part of the Report as it provides vital input to financial evaluation of the project. The cost estimates have been prepared for Strengthening of the existing road including strengthening of longitudinal drains, road furniture, site clearance and Dismantling.

Basic rates

As part of Report, Rate Analysis of each of the item has been prepared by adopting PW, P & IWTD SR 2018 - 19, Bangalore Circle. The rates as given in PW, P & IWTD SR are to be enhanced by 6% for additional weightages for the works to be executed under extra ordinary conditions for Bangalore Metropolitan Limits. Items not covered in NHSR / PW, P & IWTD SR have been based on market rates.

Project Management and Quality Control

Provision of around 2.0% of Construction Cost has been made towards Cost of DPR Preparation, Quality Control, PMC and Proof Checking.

Project Cost

The total project cost for the proposed work is 100.00 Lakh.

Detailed Cost Estimate is enclosed in **Annexure A. 5.1**

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Annexure A. 5.1
DETAILED COST ESTIMATE
RATE ANALYSIS
DRAFT TENDER SCHEDULE

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Bruhat Bangalore Mahanagara Palike

Excecutive Engineer Road Infrastructure Yelahanka Division

Name of Work: Improvements to Roads and drains of Sahakaranagar Main Road and surrounding areas in ward no. 08 Kodigehalli

Project Cost: 100.00Lakhs

Description of items	No	Length	Width	Depth	Quantity	Unit	Rate	Amount
Civil Work								
Removing and refixing stone slabs of drains and pointing in CM (1:3) (P.No-27,I No-5.33 of PWD BCSR 2018-19)								
Bottom slab								
Sahakaranagar								
Ward office Rd	2	270.00	1.50		810.00			
5th A main	2	400.00	1.50		1200.00			
12th main	2	358.00	1.50		1074.00			
21st cross	2	188.00	1.50		564.00			
					3648.00			
Consider 40%					1459.20			
Deduct 15% missing/damaged					218.88			
					1240.32			
					1240.32	Sqm	111.30	138047.62
KSRRB 300-1 Earthwork excavation by manual means for roads, drains & similar works in ordinary soil excavated surface levelled and sides neatly dressed, the disposed earth to be levelled neatly after breaking of clods complete as per specifications (P.No-143 &136 ,I No-19.1&17.4& 17.1 of PWD BCSR 2018-19) 6km lead= 57+2.0x1.28x6 =72.36, Including the cost of loading and unloading, disposal using private vehicle and lead off of 6km								
Desilt								
Sahakaranagar								
Ward office Rd	2	270.00	0.40	0.25	54.00			
5th A main	2	400.00	0.40	0.25	80.00			
12th main	2	358.00	0.40	0.25	71.60			
21st cross	2	188.00	0.40	0.25	37.60			
					243.20	Cum	214.50	52,166.79
Providing granite slabs of selected quality roughly dressed and fixed in cement mortar (1:6) including fixing curing etc., complete. (P.No-27,I No-5.31.1) 7.5cm thick								
rm item No-1 top slabs		218.88			218.88			
					218.88	Sqm	742.00	162408.96
KSRRB M2100-10. Providing and laying Plain cement concrete of mix 1:3:6 with OPC @ 220kgs, with crushed 40mm and down size graded granite metal coarse aggregates @0.89cum and fine aggregates @ 0.46cum, in foundation mechanically mixed, placed in foundation and compacted by vibration including curing for 14 days including cost of all materials, labour, HOM curing, form works, scaffolding and centering complete as per specifications. (P.No-222,I No-27.18)								
CC Drain								
LV Rice traders Rd								
Road rectification	2	152.00	1.00	0.100	30.40			
	2	25.00	1.00	0.100	5.00			
					35.40	Cum	5421.90	191935.26

23/10/2019

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Description of Items	No	Length	Width	Depth	Quantity	Unit	Rate	Amount
Providing and laying plain/reinforced cement concrete for side drains using M20 nominal mix concrete (with OPC at 300 kgs with 20mm and down size granite metal coarse aggregates at 0.69 cum and fine sand/ stone at 0.43 cum machine mixed well compacted for walls and bottom including centering, plastering, cost of materials, HOM of machinery, curing etc complete excluding cost of steel as per MORTH specification No 1500, 1700, 2200 including cost of materials, labour, HOM complete as per specificationsdo- Wall & bottom thickness 15cm (I No-37.59,P No-271 of PWD BCSR 2018-19)								
RCC Drain								
SLV Rice traders Rd Raft								
Road rectification	2	152.00	0.90	0.150	41.04			
	2	25.00	0.90	0.150	6.75			
SLV Rice traders Rd Wall								
Road rectification	4	152.00	0.20	0.400	48.64			
	4	25.00	0.20	0.400	8.00			
					104.43	Cum	7070.20	738340.99
KSRB 4.9.2 : Providing T.M.T steel reinforcement for R.C.C work including straightening, cutting, bending, hooking, placing in position, lapping and / or welding wherever required, tying with binding wire and anchoring to the adjoining members wherever necessary complete as per design (laps, hooks and wastage shall not be measured and paid) cost of materials, labour, HOM complete as per specificatio (I No-28.8.2,P No-229)								
For Drain, 50kg/cum	104.43	50.00			5.22			
					5.22	Tn	72326.98	377[illegible]
Providing and fixing RCC Precast cover slab of 250mm thick for drain in cement concrete M20 using graded granite jelly 20mm and down size with steel reinforcement, including form work, lift charges, curing and concrete finished surfaces on both sides etc, complete and as per drawing and the directions of Engineer in-charge. (Data Rate) Approved								
SLV Rice traders Rd Raft								
Road rectification	2	152.00	0.90		273.60			
	2	25.00	0.90		45.00			
					318.60	Sqm	3640.00	1159704.00
Providing and laying 100mm thick pre-cast cover slabs over drains of width not exceeding 800 mm using M20 concrete reinforced with steel @ 6.00 kg/Sqm, slabs jointed in CM 1:3 proportion and nicely finished including providing holes in the Cover slabs wherever necessary for easy drainage of surface water including of labour, materials, HOM of machineries, curing, lead and lift charges etc. Complete as per MORTH specifications No. 1500. 1700. (P.No-272 ,I No-37.66)								
Bhakaranagar								
Ward office Rd	2	30.00			60.00			
					60.00	m	1145.86	68,751.60
SRB M300-14. Excavation for roadwork in all types of soil by mechanical means including cutting and loading to tippers, trimming bottom and side slopes, in accordance with requirements of lines grades and cross sections, and transportation with a lead of 6.00 km and complete as per specificatio MORTH Specification No.301Loading and unloading with 5km lead= (I No-19.14,P No-143 of PWD BCSR 2018-19) , 5km lead= 2.0x1.28x5 =12.8 including the cost of loading and unloading, disposal using private vehicle and lead off of 6km								
RCC Drain								
SLV Rice traders Rd								
Road rectification	2	152.00	1.00	0.300	91.20			
	2	25.00	1.00	0.300	15.00			
Road Work								
Road reaches								

25/10/2019

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Description of Items	No	Length	Width	Depth	Quantity	Unit	Rate	Amount
Sahakaranagar								
Ward office Rd	2	100.00	1.50	0.150	45.00			
1st A main	1	180.00	1.20	0.150	32.40			
183.60					183.60	Cum	57.05	10,470.94

Item No 6.10 Scarifying bituminous course 50mm to 75mm thick along with premix carpet / surface dressing by mechanical means attached with scarifier without disturbing the base and stacking the debris including unit of all labour charges etc(M) complete as per specifications MORTH / Chapter 3 / Sec-9 / Pg No 146 of PWD BCSR 2018-19)

KV Rice traders Rd								
Road rectification	1	156.00	4.60		717.60			
					717.60	Sqm	41.34	29,665.58

Construction of granular sub-base Grading-V as Sub-base and drainage layer by providing coarse graded crushed stone aggregates of granite/trap/basalt material mixing by mix in place method by rotavator at OMC spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the 98 % proctor density complete as per specifications Clause 401 of MORTH v revision (No-20.6,P.No-153 of PWD BCSR 2018-19)

Edge widening								
Sahakaranagar								
Ward office Rd	2	100.00	1.50	0.150	45.00			
1st A main	1	180.00	1.20	0.150	32.40			
2nd A cross junction	2	40.00	2.00	0.150	24.00			
1st cross	1	188.00	2.50	0.150	70.50			
					171.90	Cum	1855.00	318874.50

MSRRB M400-17 Providing, laying, spreading and compacting crushed stone aggregates of granite / trap / basalt to wet mix macadam specifications including pre mixing the material with water at OMC in mechanical mix plant carriage of mixed material by tipper to site laying in uniform layers with paver in sub-base/base course on well prepared surface and compacting with vibratory roller to achieve the desired density complete as per specifications(P.No-155 / No-20.18 of PWD BCSR 2018-19)

Edge widening								
Sahakaranagar								
Ward office Rd	2	100.00	1.50	0.200	60.00			
1st A main	1	180.00	1.50	0.200	54.00			
2nd A cross junction	2	40.00	2.00	0.200	32.00			
1st cross	1	188.00	2.50	0.200	94.00			
KV Rice traders Rd								
Road rectification	1	156.00	4.60	0.300	215.28			
					455.28	Cum	2001.28	911142.76

MSRRB M 500-6, Providing and applying primer coat with SS bitumen emulsion on prepared surface of granular Base such as WBM WMM including clearing of road surface and spraying primer at the rate of 10 kg/sqm using mechanical means complete as per specifications As per MORTH specification clause no 502 (P.No 153, I.No.21.6 of PWD BCSR 2018-19) issue rate Dated 01-01-2019

Edge widening								
Sahakaranagar								
Ward office Rd	2	100.00	1.50		300.00			
1st A main	1	180.00	1.50		270.00			
2nd A cross junction	2	40.00	2.00		160.00			
1st cross	2	188.00	2.50		940.00			

23/01/2019

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Description of Items	No	Length	Width / B	Depth	Quantity	Unit	Rate	Amount
...k Ltd traders Rd								
...ification	1	156.00	4.60		718.60			
					2487.60	Sqm	28.68	70,864.97

...(cleaning the existing black topped surface with brooms, soft brushes and finally dusting with dry gunny bags and ... in compressed air to receive bituminous treatment including cost of all materials, labour, hOM complete as per specifications. (P No-158,) No-21.3 of PWD BCSR 2018-19)

...ekaranagar								
...office Rd	1	270.00	8.80		2376.00			
...n main	1	400.00	9.00		3600.00			
...4 cross junction	1	80.00	5.50		440.00			
...cross	1	188.00	7.00		1316.00			
...ri Rice traders Rd								
...ification	1	156.00	4.60		718.60			
...reduct primer coat area					2.5* 60			
					6082.00	Sqm	5.30	32,125.60

...Providing and applying tack coat using 80/100 grade bitumen(VG10) on the prepared black topped surfaces at 2.5 kg per ...sqm heating bitumen in boiler fitted with sprays set, excluding cleaning of road surface, including cost of all materials, labour, hOM complete as per specifications. (P No-156,) No-21.1 of PWD BCSR 2018-19) issue rate Dated 01-01-2019

...ge BC								
...ekaranagar								
...office Rd	1	270.00	8.80		2376.00			
...n main	1	400.00	9.00		3600.00			
...4 cross junction	1	80.00	5.50		440.00			
...cross	1	188.00	7.00		1316.00			
...ri Rice traders Rd								
	1	50.00	6.00		300.00			
...ification	1	156.00	4.60		718.60			
	1	25.00	4.60		115.00			
					8864.60	Sqm	12.72	112757.71

...MS/09-17 Providing and laying dense graded bituminous macadam using crushed aggregates of ...profiled grading, premixed with VG30 grade bituminous binder and, transporting the hot mix to work ...laying to the required grade, level and alignment, rolling with smooth wheeled, vibratory and ...gum rollers to achieve the desired compaction in all respects complete as per specifications Clause ...of MORTH V revisionusing 40/60 TPH capacity H.M.P. with Mechanical paver Gr-II (50 mm to 75 mm) ...4.5 % VG-30 Bitumen (P No-160,) No-21.17.6 of PWD BCSR 2018-19) issue rate Dated 01-01-2019

...ekaranagar								
...ile correction								
...office Rd	1	270.00	2.00	0.05	27.00			
...n main	1	400.00	2.00	0.05	40.00			
...4 cross junction	1	80.00	1.80	0.05	7.20			
...cross	1	188.00	2.50	0.05	23.50			
...ri Rice traders Rd								
	1	50.00	6.00	0.05	15.00			
...ification	1	156.00	4.60	0.05	35.88			
	1	25.00	4.60	0.05	5.75			

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Description of Items	No	Length	Width	Depth	Quantity	Unit	Rate	Amount
					154.31	Cum	6858.20	1058426.01

...ding and laying bituminous concrete 40mm thick with hot mix plant, using crushed aggregates of ...ified grading, premixed with bituminous binder and filler, transporting the hot mix to work site, ...ing with a paver finisher to the required grade, level and alignment, rolling with smooth wheeled ...atory and tandem rollers to achieve the desired compaction in all respects complete as per ...fications. Clause 507 of MORTH V revision as per IRC SP 53-2015 using – do – using 40-60 TPH ...acity HMP with mechanical paver grading II (30-45mm) with 5.4 % of modified bituminus binder ...sisting of 4.97% of VG-30 bitumen (60/70 grade) and 0.43% of plastomeric thermoplastics (waste ...astic) (P.No.171 / No.21.78.12 of PWD BCSR 2018-19) issue rate Dated 01-01-2019

...hakaranagar								
...ard office Rd	1	270.00	8.80	0.04	95.04			
...th A main	1	400.00	9.00	0.04	144.00			
...rd A cross junction	1	80.00	5.50	0.04	17.60			
...st cross	1	188.00	7.00	0.04	52.64			
...V Rice traders Rd								
	1	50.00	6.00	0.03	9.00			
...oad rectification	1	156.00	4.60	0.03	21.53			
	1	25.00	4.60	0.03	3.45			
					343.26	Cum	8049.64	2763103.33

...SRRB M800-13.Road Marking with Hot Applied Thermoplastic Compound with Reflectrising Glass ...beads on Bituminous Surface/ Concrete Surface: Providing and laying of hot applied thermoplastic ...compound 2.5 mm thick including reflectorising glass beads at 250 gms per sqm area. thickness of 2.5 ...mm is exclusive of surface applied glass beads as per IRC:35 standards specified. The finished surface to ...be level, uniform and free from streaks and holes complete as per specifications. MORTH Specification ...No. 803(P.No-182 / No-24.15 of PWD BCSR 2018-19)

...ahakaranagar								
...Ward office Rd	2.5	270.00	0.10		67.50			
...th A main	2.5	400.00	0.10		100.00			
...3rd A cross junction	2.5	80.00	0.10		20.00			
...1st cross	2.5	188.00	0.10		47.00			
...V Rice traders Rd								
	2	50.00	0.10		10.00			
...ad rectification	2	156.00	0.10		31.20			
	2	25.00	0.10		5.00			
					280.70	Sqm	454.74	127645.52

...SRB M800-35. Supply and Installtion of Moulded Shank Raised Pavement Markers made of ...ycarbonate and ABS(Acrylonitrile Butadiene Styrene) moulded body and reflective panels with micro ...matic lens capable of providing total internal reflection of the light entering the lens face and shall ...port a load of 16000 kg tested in accordance to Specifications of Category A of MORTH Circular No ...NH/33023/10-97 – DO III Dt 11.06. 1997. The height, width and length shall not exceed 50 mm, 100 ...m and 102 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base ...ll be 35 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less ...an 19 mm and height not less than 30 mm) from the body is to be a minimum value of 500 Kg. Fixing ...ll be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based ...hesive as per manufacturer's recommendation and complete as directed by the engineer (P.No-187 / ...-24.41 of PWD BCSR 2018-19)

...y Every 8.0mtr								
...nakaranagar	3	110			330.00			
					330.00	Nos	357.22	117882.60

23/10/2019

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Description of Items	No	Length	Width	Depth	Quantity	Unit	Rate	Amount
							Total Construction Cost	8441971.45
							4% KRIDL Charges	337678.86
							Sub Total 1	8779650.31
							12% GST for Sub total 1	1053558.04
							Towards DPR & PMC Cost including GST	166000.00
							Sub Total 2	9999208.35
							Utility Shifting,Miscellaneous and Rounding off	791.65
							GRAND TOTAL	10000000.00

Certificate

1. The workspot was inspected and works is found to be necessary.
2. The area comes within the Bruhat Bangalore Mahanagara Palike limits.
3. The rates adopted based on the PWD SR,Bangalore circle for year 2018-2019, issue rates dated 01-01-2019 and Data Rates

Assistant Engineer
RI,Yelahanka Division
BBMP Bangalore

Asst. Executive Engineer,
RI,Yelahanka Division
BBMP Bangalore

Executive Engineer,
RI,Yelahanka Division
BBMP Bangalore

Administrative sanction for Rs. 1,00,00,000/-
(Rs. One Crore only)
is accorded 2019-20 BBMP Grant L-2902, ESCROW Account works SL No-118, 008-20-000034
Registered as C.E. No. AS/167/2019-20 & Subject to conditions enclosed in memo No. AS/167/2019-20 & Dt. 23/10/2019
AE/JE 23/10/2019
CE (RI)

Technically sanctioned for Rs. 1,00,00,000/-
Rs. One Crore only
under 2019-20 BBMP Grant L-2902, ESCROW Account works SL No-118, B08-20-000034
Registered as C.E. No. TS/124/2019-20 & Subject to conditions enclosed in memo No. TS/124/2019-20 & Dt. 23/10/2019
AE/JE 23/10/2019
CE (RI)

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